Numerical modelling of the Ceppo Morelli landslide (Italian Alps)

Author: Alfredo Arias Vicente

Tutors: Pere Prat and Marcel Hürlimann

Great landslides are among the natural disasters that destroy the territory. During last October 2000, Ceppo Morelli, a little village in the Italian Alps, suffered heavy rainfalls that provoked the last landslide of the local history.

These events affect negatively the course of everyday life. Modern society tries to apply the most advanced methods in order to prevent and mitigate such disasters.

Our objective is to continue pioneer work on evaluation of the state of mountain slopes using the Finite Element Method (FEM) in order to detect risk of failure and apply appropriate corrective measures. Moreover, we are able to detect the origin of these instabilities, which we locate in the last deglatiation of the Quaternary Era.

This process has been carried out in various steps. The first one consists in gathering and examining information to better understand the state of the site, and establish basic ideas that will be checked *in situ*. With these studies we are able to idealize the reality of the place and by removing side factors we obtain best results at minimum cost.

With such idealization we have created a two-dimensional model of one of the sections of the studied slope. It is crucial that the discontinuities present in this slope are reproduced. Various families of interface systems are found in the rock mass, however, we have only modelled the most representative ones (two in this case).

Once the main features of the landslide have been extracted, we are ready to perform the analysis with FEM. First, we build the finite element mesh, which will be introduced in the software program DRAC, property of the Department of Geotechnical Engineering (UPC).

Since we are uncertain how to best represent the motion dynamics, we have implemented various models on the same finite element mesh, varying boundary conditions, including the presence of interface systems, modifying constitutive laws and introducing the glacial effect.

The results obtained by the FEM method imply to a certain extent that the deglaciation could have triggered the landslide. However, other factors such as the presence of water, tensions induced by techtonics or the erosion provoked by the glacier and the river have also a significant effect.